The coroner arrived at midnight and found the victim's body temperature was 56.49°F. Three hours later, the temperature was 37.20°F.

(a) If the body temperature decreases exponentially, write a function for the body temperature with respect to time. Round to 3 decimal places.

$(0, 56.49)$ $(3, 37.20)$

$y = ab^x$

$56.49 = ab^0$

$\underline{56.49 = a}$

$$\frac{37.26}{56.49} = \frac{56.49b^3}{56.49}$$

$\sqrt[3]{0.6\ldots}$ $\sqrt[3]{b^3}$

$b = 0.87$

$y = 56.49(0.87)^x$

(b) Approximately what time did the victim die? (I.e. what time was the body temperature 98.6°F?)

$$\frac{98.6}{56.49} = \frac{56.49(0.87)^x}{56.49}$$

$1.745 = 0.87^x$

$$x = \frac{\log 1.745}{\log 0.87} \approx -4$$

① Solve for x

(a) $8^x = 50$

$x = 1.881$

(b) $\log_5 280 = x$

$x = 3.501$

(c) $\ln 150 = x$

$\log_e 150 = x$

$x = 5.011$

(d) $\log_x 343 = 3$

$\sqrt[3]{x^3} = \sqrt[3]{343}$

$x = 7$

(e) $e^x = 217$

$\ln 217 = x$

$x = 5.380$

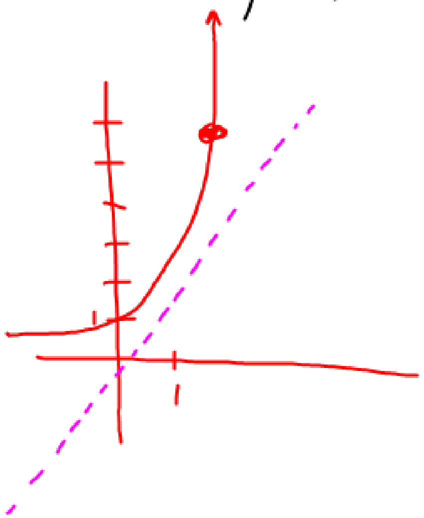
(f) $\frac{8(1+0.05)^x}{8} = \frac{24}{8}$

$1.05^x = 3$

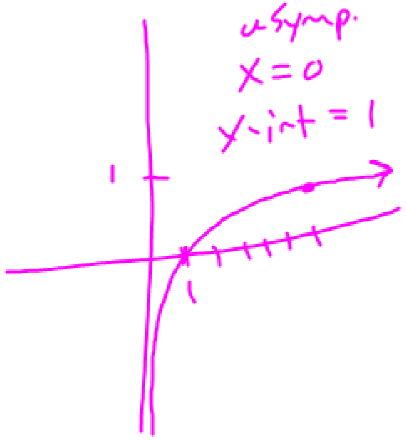
$x = 22.517$

② Graph by hand and find domain, intersects, and asymptotes

(a) $y = 6^x$

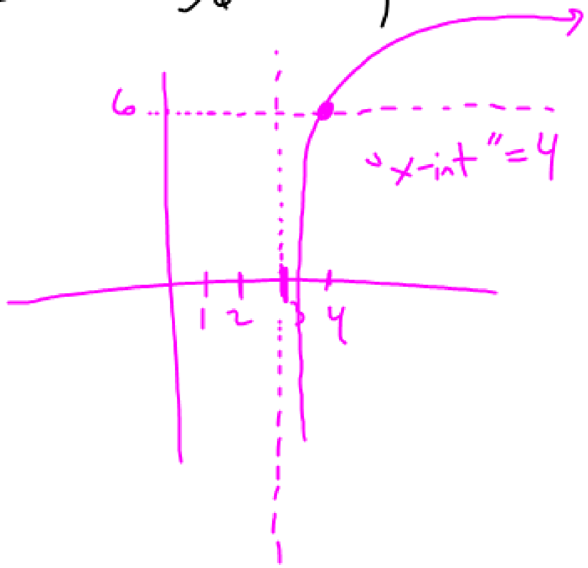


(b) $y = \log_6 x$



(c) $6 + \log_6(x-3)$

asymp. $x=3$



Properties of Exponents

① $a^m \cdot a^n = a^{m+n}$

② $\dfrac{a^m}{a^n} = a^{m-n}$

③ $(a^m)^n = a^{mn}$

④ $a^{m/n} = \sqrt[n]{a^m}$ or $(\sqrt[n]{a})^m$

⑤ $a^0 = 1$

⑥ $a^{-n} = \dfrac{1}{a^n}$

⑦ $\left(\dfrac{a}{b}\right)^{-n} = \dfrac{b^n}{a^n}$

⑧ $(ab)^n = a^n b^n$

$y = 2^x$

-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4
3	8
4	16

$a^{\frac{m}{n}} = \sqrt[n]{a^m}$

$4^{\frac{1}{2}} = \sqrt{4} = 2$

$8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

$343^{\frac{1}{3}} = \sqrt[3]{343} = 7$

$256^{\frac{1}{4}} = \sqrt[4]{256} = 4$

$8^{\frac{4}{3}} = \left(8^{\frac{1}{3}}\right)^4$

$(2)^4 = 16$

$\left(\sqrt[3]{8}\right)^4$

$\sqrt[3]{8^4}$

$$\left(\frac{2}{3}\right)^{-1} \rightarrow \frac{1}{\frac{2}{3}} \Rightarrow \frac{1}{1} \cdot \frac{3}{2} = \frac{3}{2}$$

$$\left(\frac{2}{3}\right)^{-2} = \frac{1}{\left(\frac{2}{3}\right)^{2}} = \frac{9}{4} = \frac{3^2}{2^2}$$

$$\frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$$

Properties of Logs - Basic

$a^x = y$

$\log_a y = x$

① $\log_a 1 = 0$ b/c $a^0 = 1$

② $\log_a a = 1$ b/c $a^1 = a$

$\cancel{\sqrt{x^2}}$ $\cancel{(\sqrt{x})^2}$

③ $\log_a a^x = x$ and $a^{\log_a x} = x$ inverse property

④ If $\log_a x = \log_a y$ then $x = y$ one-to-one property

* All properties also hold with the natural log

Do these Problems and pay attention

1. $\log 2 + \log 5 = 1$ $\qquad \log(10) = 1 \qquad \log x + \log y = \log(xy)$

2. $\log 2 + \log 50 = 2$ $\qquad \log(100) = 2$

3. $\log 20 + \log 50 = 3$ $\qquad \log(1000) = 3$

4. $\log(150) = 2.176$

5. No Calc, what is $\log 3 + \log 50$? $\quad 2.176$

Cont.

$$\log x - \log y = \log\left(\frac{x}{y}\right)$$

① $\log 50 - \log 5 = 1$

② $\log 3000 - \log 3 = 3$

③ $\log 150 - \log 1.5 = 2$

④ $\log(150) = 2.176$

⑤ No Calc, what is $\log 450 - \log 3$? 2.176

cont.

① compare $\overset{2}{\log 100}$ and $\overset{6}{\log(100^3)}$

$\log x^n = n \cdot \log x$

② compare $\overset{3}{\log 1000}$ and $\overset{12}{\log 1000^4}$

③ compare $\overset{0.3}{\log 2}$ and $\overset{0.9}{\log 2^3}$

④ $\log(1.78) = 0.25$

⑤ No Calc, find $\log 1.78^3$ 0.75

Properties of Logarithms

① $\log_a x + \log_a y = \log_a(xy)$ $\qquad$ $\ln x + \ln y = \ln(xy)$

② $\log_a x - \log_a y = \log_a\left(\frac{x}{y}\right)$ $\qquad$ $\ln x - \ln y = \ln\left(\frac{x}{y}\right)$

③ $\log_a x^n = n \cdot \log_a x$ $\qquad$ $\ln x^n = n \ln x$

Use the properties of logarithms to expand

(a) $\log_4 5x^3y$

$\log_4 5 + \log_4 x^3 + \log_4 y$

$\downarrow$

$\boxed{\log_4 5 + 3\log_4 x + \log_4 y}$

(b) $\ln\left(\frac{\sqrt{3x-5}}{7}\right) = \ln\left(\frac{(3x-5)^{\frac{1}{2}}}{7}\right)$

$\ln(3x-5)^{\frac{1}{2}} - \ln(7)$

$\downarrow$

$\frac{1}{2}\ln(3x-5) - \ln(7)$

Use the properties of logarithms to condense

ⓐ $\frac{1}{2}\log_8 x + 3\log_8(x+1)$

$\downarrow$

$\log_8 x^{\frac{1}{2}} + \log_8 (x+1)^3$

$\log_8\left(\sqrt{x}(x+1)^3\right)$

ⓑ $2\ln(x+2) - \ln x$

$\ln(x+2)^2 - \ln x$

$\ln\left(\frac{(x+2)^2}{x}\right)$

$\boxed{\text{HW}}$ Sect. 3.3 #9-16(4), 19, 20, 23-42(2 easy, 2 hard),

45-62(2 easy, 2 hard), 67, 71, 77